



E-ISSN: 2278-4136

P-ISSN: 2349-8234

JPP 2018; 7(3): 1360-1363

Received: 21-03-2018

Accepted: 25-04-2018

Yemane Tilahun

Department of Biology, College
of Natural and Computational
Sciences, Adigrat University,
Adigrat, Ethiopia

Gebrekidan Welegerima

Department of Biotechnology,
College of Natural and
Computational Sciences, Adigrat
University, Adigrat, Ethiopia

Pharmacological potential of cactus pear (*Opuntia ficus Indica*): A review

Yemane Tilahun and Gebrekidan Welegerima

Abstract

Plants with strong bioactive constituents have recently gained much interest for improving overall well being as well as for prevention and treatment of various diseases. The presence of potentially active constituents in cactus pear and their multifunctional action, make cactus pear (*Opuntia ficus Indica*) ideal candidate for the production of health-promoting foods and pharmacologicals. Despite the appreciation by its pharmacological property in different counties, cactus pear is still scarcely used in modern nutrition and medicine. However, recent studies on cactus pear revealed that the different parts of the plant to be potential candidates for the development of healthy foods and pharmaceuticals. Hence, this review is intended to summarize recent developments of the use of cactus for diverse pharmacological importance.

Keywords: pharmacological, cactus, *Opuntia ficus Indica*, bioactive constituents

Introduction

Plants with strong constituents have recently gained much interest for improving overall well being as well as for prevention and treatment of various diseases. It is generally believed that the beneficial effect of herbal remedies can be obtained from active constituents present in the whole plant, parts of the plant (flowers, fruits, roots or leaves), or plant materials or combination thereof (Ahn, 1998; De Smet, 2002) ^[1, 6]. Cactus (*Opuntia ficus indica*) commonly known as prickly pear belongs to the family Cactaceae. Family Cactaceae is reported to have 130 genera and nearly 1500 species, which were originally native to the new world. Being so water-use efficient, they are highly useful in arid and semi arid environments (Griffith, 2004; Pareek *et al.* 2003) ^[13, 24].

Cactus produces sweet, nutritionally rich edible fruits; its tender cladodes are used as fresh green vegetable and salad (Griffith, 2004) ^[13]. Cactus is used in nutrition, health, cosmetics and others. The fruit as well as cactus stem are used to prepare value added products such as jam, wine, body lotions, shampoo and creams (Pareek *et al.* 2003) ^[24]. It also has been traditionally used in folk medicine in several counties for several medicinal purposes because of its role in treating a number of diseases and conditions, anti-inflammatory effects (Hunt *et al.* 2006; Salim *et al.* 2009) ^[15, 26], hypoglycemic effects (Paiz *et al.* 2010; Schaffer *et al.* 2005) ^[22, 27], antimicrobial activity (Ennouri *et al.* 2014; Yasmeen *et al.* 2012) ^[8, 31], anticancer effect (Zou *et al.* 2001) ^[32], inhibition of stomach ulceration (Kunti, 2004) ^[17], antioxidant effects (Galati *et al.* 2003; Kunti, 2004; Zou *et al.* 2001) ^[9, 17, 32], and neuroprotective effects (Dok-Go *et al.* 2003) ^[7].

Recent scientific studies have demonstrated the presence of potential phytochemicals in cactus or in its different parts, which may have high potential interest in human health and medicine (Almimi *et al.* 2010; Valente *et al.* 2010) ^[3, 29]. As a general rule in herbal medicine, the extraction of phytochemicals from plant materials using solvents represents a key step in the manufacturing of phytochemical rich products. Researchers have focused their investigation on cactus to find out the properties of the plant that could be the basis to use in the prevention and treatment different diseases (Harnandaz *et al.* 2011) ^[14]. Moreover, recent studies on cactus revealed that the different parts of the plant to be potential candidates for the development of healthy foods and pharmaceuticals. Therefore, this review is intended to summarize recent developments on the pharmacological importance of cactus.

Origin and distribution of *Opuntia ficus Indica*

Opuntia spp. Originated in the tropical and subtropical Americas and the plant have spread further into other continents - carried by peoples. Cactus pear (*Opuntia ficus indica*) is a suitable plant for water scarcity regions. It is a succulent, xerophytic, spiny or spineless plant of multiple purposes (Griffith, 2004) ^[13]. The plant has different parts, which includes flower,

Correspondence**Yemane Tilahun**

Department of Biology, College
of Natural and Computational
Sciences, Adigrat University,
Adigrat, Ethiopia

seed, cladodes, skin fruit and pulp.

Botanic description

Kingdom : Plantae
Division : Magnoliophyta
Class : Magnoliopsida
Order : Caryophyllales
Family : Cactaceae

Traditional Uses

Cactus pear (*Opuntia ficus indica*) used as a folk medicine in different counties for the treatment of burns, wounds edema and indigestion. As report of different studies, it has been revealed that its alcoholic extracts possess anti-inflammatory, hypoglycemic, antibacterial activities. Moreover, the prickly pear cactus stem have been used traditionally to treat diabetics (Saenz, 2000) [25].

Phytochemical composition of cactus

The cladodes and skin fruit of cactus have found to be potential source of useful phytochemicals like ascorbic acids, vitamins, carotenoids, fibers, amino acids, antioxidant compounds (flavonoids, betaxanthin, betacyanin, and alkanoids) (Ennouri *et al.* 2014; Yasmeen *et al.* 2012) [8, 31]. Also, cactus flowers contains different flavonoids notably kaempferol and quercetin (Kunti, 2004; Moussa *et al.* 2011) [17, 20].

Pharmacologic activities

Opuntia ficus Indica have been used by humans for many years. Besides being consumed as food or beverages, most portions of *Opuntia ficus indica* have been used as medicine and in recent times have also been prepared as juice, jam, frozen fruit and spray dried powder (Salim *et al.* 2009) [26]. According to different studies, the *Opuntia ficus Indica* have different pharmacological activities and presented in summarized form in Table 1.

Anti-inflammatory activity

Many studies have reported that the analgesic and anti-inflammatory actions of *Opuntia* by using either fruit extract, lyophilized cladodes, or the phytosterols from fruit and stem extracts (Allegra *et al.* 2014; Kemi *et al.* 2006; Panico *et al.* 2007; Tesoriere *et al.* 2014) [2, 16, 23, 28]. Moreover, *Opuntia ficus indica* has been reported to have anti-inflammatory activity due to B-sitosterol extract from the stem of cactus (Allegra *et al.* 2014) [2]. This the first evidence on the anti-

inflammatory activity of B-Sitosterol lyophilized aqueous extract of the fruit of *Opuntia ficus indica*.

Anti-ulcer activity

In Sicily folk medicine, *Opuntia ficus indica* cladodes are used for treatment of gastric ulcer and its cicatrissant action. The effect of lyophilized cladodes on ethanol induced ulcer in rat was investigated and the ultra-structural changes were observed by TEM, confirming the protective effect exercised by administration of lyophilized cladodes. The reason might be the mucilage of *Opuntia ficus indica* was the principal compound for antiulcer action (Galati *et al.* 2003) [9].

Antioxidant activity

The ethanol extract of stem of *Opuntia ficus indica* was assessed to determine the mechanism of its antioxidant property. The ethanol extract revealed a concentration dependent inhibition of linoleic acid oxidation in the thiocyanate assay system. Moreover, the extract showed dose-dependent free radical scavenging activity. Hence, the ethanol extract was found to be potential in protecting plasmid DNA against the strand breakage induced by hydroxyl radicals. The ethanol extract was determined as containing a high amount of phenolic compounds responsible for antioxidant activity of the extract (Butera *et al.* 2002; Gentile *et al.* 2004) [4, 12].

Antibacterial activity

According to recent study (Gebrekidan and Aragaw, 2017) [11], the antibacterial activity of methanol, ethanol, chloroform extracts of cladodes and skin fruit extracts of *Opuntia ficus indica* have demonstrated great antibacterial activity against both gram positive and gram negative bacteria. The antibacterial activity might be due the presence of various bioactive constituents in the extracts.

Antiviral activity

Study conducted by Gentile *et al.* (2004) [12] demonstrated that the administration of a cactus stems extract (*Opuntia ficus indica*) to mice, horse, and humans' inhibits intracellular replication of a number of DNA and RNA viruses.

Antidiabetic activity

The prickly pear cactus stems have been used traditionally to treat diabetes in Mexico (Almimi *et al.* 2010) [3]. In recent times, *Opuntia* spp. are among the main of products recommended by Italian herbalists, which may be effective in reducing glycemia (Morales *et al.* 2012) [19].

Table 1: Main Biological Effects of Cactus Preparations

Biological activity	Source of Cactus Products	References
Antimicrobial	Methanol extract of cladodes and skin fruit	(Gebrekidan and Aragaw, 2017) [11]
	Ethanol extracts of cladodes and skin fruit	(Gebrekidan and Aragaw, 2017) [11]
	Chloroform extracts of cladodes and skin fruit	(Gebrekidan and Aragaw, 2017) [11]
	Hexane extracts of cladodes	(Ennouri <i>et al.</i> 2014) [8]
	Aqueous alcoholic extracts of cladodes Cactus stem extract	(Ennouri <i>et al.</i> 2014; Yasmeen <i>et al.</i> 2012) [8, 31]
Anti-inflammatory and antioxidant	Butanol and methanol extract of fruit	(Allegra <i>et al.</i> 2014; Kemi <i>et al.</i> 2006; Panico <i>et al.</i> 2007; Tesoriere <i>et al.</i> 2014) [2, 16, 23, 28]
Hypolipidemic and Hypocholesterolemic	Cladodes powder	(Dok-Go <i>et al.</i> 2003) [7]
	Cladodes (Glycoprotein)	Yasmeen <i>et al.</i> 2012) [31]
	Seed powder and oils	(Morales <i>et al.</i> 2012) [19]
Antidiabetic	Capsule: cladodes and skin fruit extract	(Morales <i>et al.</i> 2012) [19]
	Cactus powder in capsule	(Almimi <i>et al.</i> 2010) [3]
	Aqueous extract of skin fruit and cladodes and mixture cladodes and skin fruit extracts Capsule	(Butterweck <i>et al.</i> 2011; Van <i>et al.</i> 2012) [5, 30]
Hypoglycemic	Polysaccharide extracts from cladodes	(Paiz <i>et al.</i> 2010) [22]
	Extract powder racket after drying	(Schaffer <i>et al.</i> 2005) [27]

Anti-inflammatory	Indicaxanthin from fruit	(Tesoriere <i>et al.</i> 2014) ^[28]
	Lipophilized extracts of cladodes	(Panico <i>et al.</i> 2007) ^[23]
	Indicaxanthin from cactus pear fruit	(Kemi <i>et al.</i> 2006) ^[16]
	Methanol extracts of cactus stem and Methanol extracts of prickly pear fruit	(Allegra <i>et al.</i> 2014) ^[2]
Antioxidant	Betalain a pigment purified from fresh pulp of cactus pear	(Gentile <i>et al.</i> 2004) ^[12]
	Betanin prickly pear fruit extracts	(Butera <i>et al.</i> 2002) ^[4]
	Ethanol extract of stem	(Lee <i>et al.</i> 2002) ^[18]
	Cactus pear fruit	(Oh <i>et al.</i> 2006) ^[21]
	Flavonoids fraction from of juice of whole fruits	(Dok-Go <i>et al.</i> 2003) ^[7]
	Glycoprotein isolated from <i>Opuntia ficus indica</i> var. sabotenmakino	(Paiz <i>et al.</i> 2010) ^[22]
Anticancer	Cactus pear fruit extract	(Galati <i>et al.</i> 2002) ^[10]
Hepatoprotective	Cladodes extract	(Dok-Go <i>et al.</i> 2003) ^[7]
Neuroprotective	Methanol extract of skin fruit	(Dok-Go <i>et al.</i> 2003) ^[7]
Antiulcer	Lyophilized cladodes Pectin polysaccharides cladodes	(Galati <i>et al.</i> 2003) ^[9]

Conclusion

The review literature revealed the presence of many bioactive constituents in cactus (*Opuntia ficus Indica*), which could be responsible for various nutritional, medicinal and pharmacological uses of cactus (*Opuntia ficus Indica*). Beside the phytochemicals present in cactus different parts, this review has also devoted a great attempt to demonstrate the biological activities of the different parts of cactus. Further studies need to be carried out on cactus (*Opuntia ficus Indica*) in order to confirm its medicinal uses and also explore other potential pharmacological activities. This plant could serve as source of bioactive constituents for future pharmacological studies and drug development.

References

- Ahn DK. Illustrated book of Korean medicinal herbs. Kyodak Publishing Company, Seoul, South Korea, 1998.
- Allegra M, Ianora A, Tersigni M, Panza E, Tesorier L, Livrea MA. Indicaxanthin from cactus pear fruit exerts anti-inflammatory effects in carrageenan-induced rat pleurisy, *J Nutr.* 2014; 144:185-192.
- Almimi H, Hafaiedh N, Bouoni Z, Hafaiedh M, Sakly M, Zourgui L *et al.* Antioxidant and antiulcerogenic activity of *Opuntia ficus indica* f. *inermis* root extract in rats. *Phytomedicine* 2010; 17:1120-1126.
- Butera D, Tesoriere L, Di Gaudio F, Bongiorno A, Allegra M, Pintaudi AM *et al.* Antioxidant activities of Sicilian prickly pear (*Opuntia ficus indica*) fruit extracts and reducing properties of its betalains: Betalain and indicaxanthin. *J Agri. Food Chem.* 2002; 50:6895-6901.
- Butterweck V, Semlin L, Feistel B, Pischel I, Bauer K, Verspohl EJ *et al.* Comparative evaluation of two different *Opuntia ficus indica* extracts for blood sugar lowering effects in rats. *Phytother. Res.* 2011; 25:370-375.
- De Smet PA. Herbal remedies. *N. Engl. J Med.* 2002; 347:2046-2056.
- Dok-Go H, Lee KH, Kim HJ, Lee EH, Lee J, Song YS *et al.* Neuroprotective effects of antioxidative flavonoids, quercetin, (+)- Dihydroquercetin and quercetin 3-methyl ether, isolated from *Opuntia ficus indica* varsabotan *Brai Res.* 2003; 965:130-136.
- Ennouri M, Ammar I, Khema khem B, Attia H. Chemical composition and antibacterial activity of *Opuntia ficus indica* F. *inermis* (cactus pear) Flowers. *J Med. Food.* 2014; 17:908-914.
- Galati EM, Mondello MR, Giuffrida D, Dugo G, Miceli N, Pergolizzi S, *et al.* Chemical Characterization and biological effects on Sicilian *Opuntia ficus Indica* (L.) Mill. Fruit juice: Antioxidant and anticarcinogenic activity. *J Agri. Food Chem.* 2003; 51:4903-4908.
- Galati EM, Pergolizzi N, Miceli MT, Monforte MM, Tripodo. Study on the increment of the production of gastric mucus in rates treated with *Opuntia ficus indica* (L.) Mill Cladodes. *J Ethnopharmacology.* 2002; 83:229-233.
- Gebrekidan W, Aragaw Z. Antibacterial activity of *Opuntia ficus indica* skin fruit extracts. *Biotechnology International.* 2017; 10(3):74-83.
- Gentile C, Tesoriere L, Allegra M, Livrea MA, Alession P. Antioxidant betalians from cactus *prea* (*Opuntia ficus Indica*) inhibit endothelial ICAM-1 expression, *Ann. N.Y. Acad. Sci* 2004; 1028:481-486.
- Griffith MP. The origins of an important cactus crop, *Opuntia ficus-indica* (Cactaceae, new molecular evidence, *AM J Bot.* 2004; 91:1915-1921.
- Harnandaz- Urbiola MI, Perez-Trrero E, Rodrigues-Garcia ME. Chemical analysis of nutritional content of prickly pads (*Opentia ficus Indica*) at varied age in an organic harvest, *Int J Enviror Public healt.* 2011; 8:1287-1295.
- Hunt D, Taylor NP, Charles G. The new cactus lexicon, Dh books, Milborne port, UK, 2006.
- Kemi JH, Park SM, Moon CJ, Shin TK, Kim JM, Lee NH *et al.* *Opentia ficus-indica* Attenuates neuronal injury in in vitro and in vivo moels cerebral ischemia, *J Ethnopharmacol.* 2006; 104:257-262.
- Kunti JO. Antioxidant compounds from four *Opuntia* cactus pear fruit varieties. *Food chem* 2004; 85:527-533.
- Lee JC, Kim HR, Kim J, Jang YS. Antioxidant property of an ethanol extract of the stem of *Opentia ficus-indica* var, Saboten. *J Agric. Food chem.* 2002; 50:6490-6496.
- Morales P, Ramirez- Moreno E, De Cortes M, Carvalho AM, Ferreira ICFR. Nutritional and antioxidant properties of pulp and seeds of two *xoconostel* cultivars (*Opuntia joconostle* F.A.C. Weber ex diguet and *Opuntia matudaescheinvar*) of high consumption in Mexico, *Food Res. Int.* 2012; 46:279-285.
- Moussa-Ayoub TE, El-Samahy SK, Kroh LW, Rhon S. Identification and quantification of flavonolglycons in cactus pear (*Opuntia ficus-indica*) fruit using a commercial pectinaes and cellulose preparation, *Food Chem.* 2011; 124:1177-1184.
- Oh, Lim KT. Glycoprotein (90 kDa) isolated from *Opuntia ficus-Indica* varsaboten MAKINO lowers plasma lipid level through scavenging of intracellular radicals in Triton WR-1339-induced mice, *Pharm. Bull* 2006; 29:1391-1396.

22. Paiz RC, Juarez-flores BI, Aguirre RJR, Chardensa OC, Reyes AJA, Garcia CE *et al.* Glucose-lowering effect of xocnostle (*Opuntia joconostle* A. Web. *Cactaceae*) in diabetic rats, *J Med plants Res.* 2010; 4:2326-2333.
23. Panico AM, Cardile V, Garufi F, Puglia C, Bonina F, Ronsisvalle S. Effect of hyaluronic acid and polysaccharide from *Opuntia ficus-Indica* cladodes on the metabolism of human chanddrocytesculyures, *J Ethnopharmacol.* 2007; 111:315-321.
24. Pareek OP, Singh RS, Vashishtha BB. Performance of cactus pear (*Opuntia ficus Indica* [L. Mill] clones in hot Arid region of India, *Journal of the professional association for cactus development.* 2003; 5:121-130.
25. Saenz C. Processing techniques an alternative for cactus pear (*Opuntia* spp) fruit and cladodes, *Journal of arid environment.* 2000; 46:209-225.
26. Salim N, Abdelwahab C, Rabah C, Ahcene B. Chemical composition of *Opuntia ficus-indica* (l.) fruit, *African journal of Biotechnology.* 2009; 898:1623-1624.
27. Schaffer S, Schmitt-schilling S, Muller WE, Eckert GP. Antioxidant properties of Mediterranean food plant extracts: Geographical differences. *J Physiol. Pharmacol.* 2005; 56:115-124.
28. Tesoriere L, Attanzio A, Allegra M, Gentile C, Livrea MA. Indicaxanthin inhibits NADPH oxidase (NOX)-1 activation and NF-Kb-dependent release of inflammatory mediators and prevents the increase of epithelial permeability in IL-1 B-exposed caco-2 cells. *Br. J Nutr.* 2014; 111:415-423.
29. Valente LMM, Da Paixao D, Do Nascimento AC, Dos Santos PFP, Scheinvar LA, Moura MR, *et al.* Antiradical activity, nutritional potential and flavonoids of the cladodes of *Opuntia ficus Indica* (Cactaceae). *Food Chem.* 2010; 123:1127-1131.
30. Van Proeyen K, Ramaekers M, Pischel I, Hespel P. *Opuntia ficus Indica* ingestion stimulates peripheral disposal of oral glucose before and after exercise in the healthy men. *Int. J Sport Nutr. Exerc. Metab.* 2012; 22:284-291.
31. Yasmeen R, Hashmi AS, Anjum AA, Saeed S, Muhammad K. Antibacterial activity of indigenous herbal extracts against urease producing bacteria. *J. Anim. Plant. Sci.* 2012; 22:416-419.
32. Zou DM, Brewer M, Garcia F, Feugang JM, Wang J, Zang R. Cactus pear: a natural product in cancer chemoprevention. *Nutr. J.* 2001; 4:25.